APPLYING THE QUANTITATIVE EVALUATION FRAMEWORK MODEL FOR ENSURING THE MOOC QUALITY

Bertil P. Marques, Ana Barata, Piedade Carvalho, Ana Silva, Patrícia Queirós and Paula Escudeiro
GILT - ISEP
Rua Dr. António Bernardino de Almeida, 431 – 4200-072 Porto, Portugal

ABSTRACT

Producing quality digital educational content is the goal of any teaching/learning system, including the teaching/leaning technologies contexts. This paper introduces how the Quantitative Evaluation Framework may be used to accurately evaluate the digital content produced throughout the development process of an inclusive and integrative MOOC in Educational Technologies, based on a Postgraduate Degree from Instituto Superior de Engenharia do Porto (School of Engineering at the Polytechnic Institute of Porto). The model is sustained in the SCORM standards, adopting the ISO 9126 standard as a reference, and it proposes a quantitative representation in an orthogonal three-dimensional environment: pedagogical, ergonomics, and management. Each of these domains comprises a set of factors for which it is quite relevant to determine the degree of the system's performance. The factor is a component that represents the performance degree of the digital content in the system, following a predetermined quality criterion. The measurement of the quality of the educational digital contents is assured by quantitative methods, similar to the evaluation techniques commonly used in the education system, which makes its application simpler.

KEYWORDS

MOOC Pedagogical Model, Digital Educational Content, QEF, Evaluation Digital Contents

1. INTRODUCTION

Considering the History of Education in Portugal, grammar and high school teachers develop their professional activity in accordance with the fundamental principles consigned in the Portuguese Constitution and in both the general and specific principles of the Ministry of Education (ECD, 2010), which imply the constant need for teachers to be professionally up-to-date not only regarding the contents in their knowledge areas but also concerning the pedagogical approaches. Therefore, it is extremely relevant to invest in this continuous update.

Having that need in mind, a postgraduation sustained in an innovative concept was conceived and made available targeting at the professionals in Education already in practice or concluding undergraduation (Marques & Escudeiro, 2016). That postgraduation is divided into two different courses, both complying with the needs of the professionals in Education: a postgraduation in Supporting Technologies for Education (TAE), and a postgraduation in Informatics in Education (IE). Their particularity and uniqueness concern their modular working structure enabling a flexible enrolment of the participants, as presented in Marques & Escudeiro (2016), and available in ESTAE, 2012.

After realizing the limitations of the blended learning model to reach the target audience widely, an inclusive and innovating pedagogical model started being devised, having as premise the at distant educational model known as Massive Open Online Course (MOOC). This pedagogical model will enable the development of a course model based on the learning process (versus accreditation), making use of Web tools which allow any person holding minimal computer user's expertise to enlarge and/or improve their knowledge in a certain topic, or to learn new contents (Escudeiro, 2016), (Marques *et al.*, 2017).

The development of this Postgraduation in a MOOC, relying on internet connectivity, widens the possible participants to unlimited numbers, opening the access to knowledge in any part of the Planet with no time limits – people anywhere have access to learning by the principles of the called distance education and open education.

In these specific MOOCs it is intended to create an inclusive model which will allow the participation of deaf and of blind people. Hence, the authors are innovating in the Educational field.

In order to assure the postgraduation degrees' homogeneous features, a model comprising a set of recommendations grounded in a pedagogical structured supported by an online adapted technology is being devised, i.e. a common model to every MOOC. Within this format, any content production must consider the following decisive factors: structure, length, pedagogical design, content production and validation (Escudeiro, 2016).

Following the creation of a MOOC pedagogical model in Educational Technologies, this paper presents the quality and evaluation model applied to guarantee the quality control of all the digital content produced. This quality model is called Quantitative Evaluation Framework (QEF), and it applies a survey based analysis as well as an example of a MOOC model (Escudeiro & Bidarra, 2006).

2. MOOC PEDAGOGICAL MODEL

The development of the MOOC pedagogical model introduced in this paper comprehends two Postgraduation degrees: The Informatics in Education (IE) and the Supporting Technologies for Education (TAE). In the subsections that follow both the implemented pedagogical model and the designed solution are described.

2.1 Implemented Pedagogical Model

The proposed pedagogical model implies at its founding the involvement of multidisciplinary teams, constituted by professionals with distinct backgrounds, so that an accurate educational environment may be built comprising an accessible, inclusive and innovative pedagogical setting.

Planning is the fundamental and grounding task, common to all the individuals involved in the development process. Throughout the conception of the pedagogical model, there was especial focus on the team to guarantee the active participation of all individuals in accordance with the objectives previously set and the defined plan. The cohesion and compromise of the team enable a consistent development which will lead to a product totally adapted to a specific target as presented in Figure 1.

As for the technical aspects, the computer team in the conceptual schematics (Figure 1) represents the team of programmers who are responsible for developing the Sign language application that will enable the deaf and hearing impaired to have access to the digital content as well. This application, named VirtualSign (GILT, 2016), particularly used in educational contexts allows the deaf and the hearing impaired to have access to both digital educational contents and digital learning objects.

The MOOC design is the design team's responsibility. This team is, therefore, responsible for the storyboards which guide the alignment of the lessons' recordings so that flaws in the planning and tasks performance may be avoided. The design team is also in charge of video recording, image and audio editing, animations and graphics integration, closely following the contents selected and aligned by the specific responsible teacher.

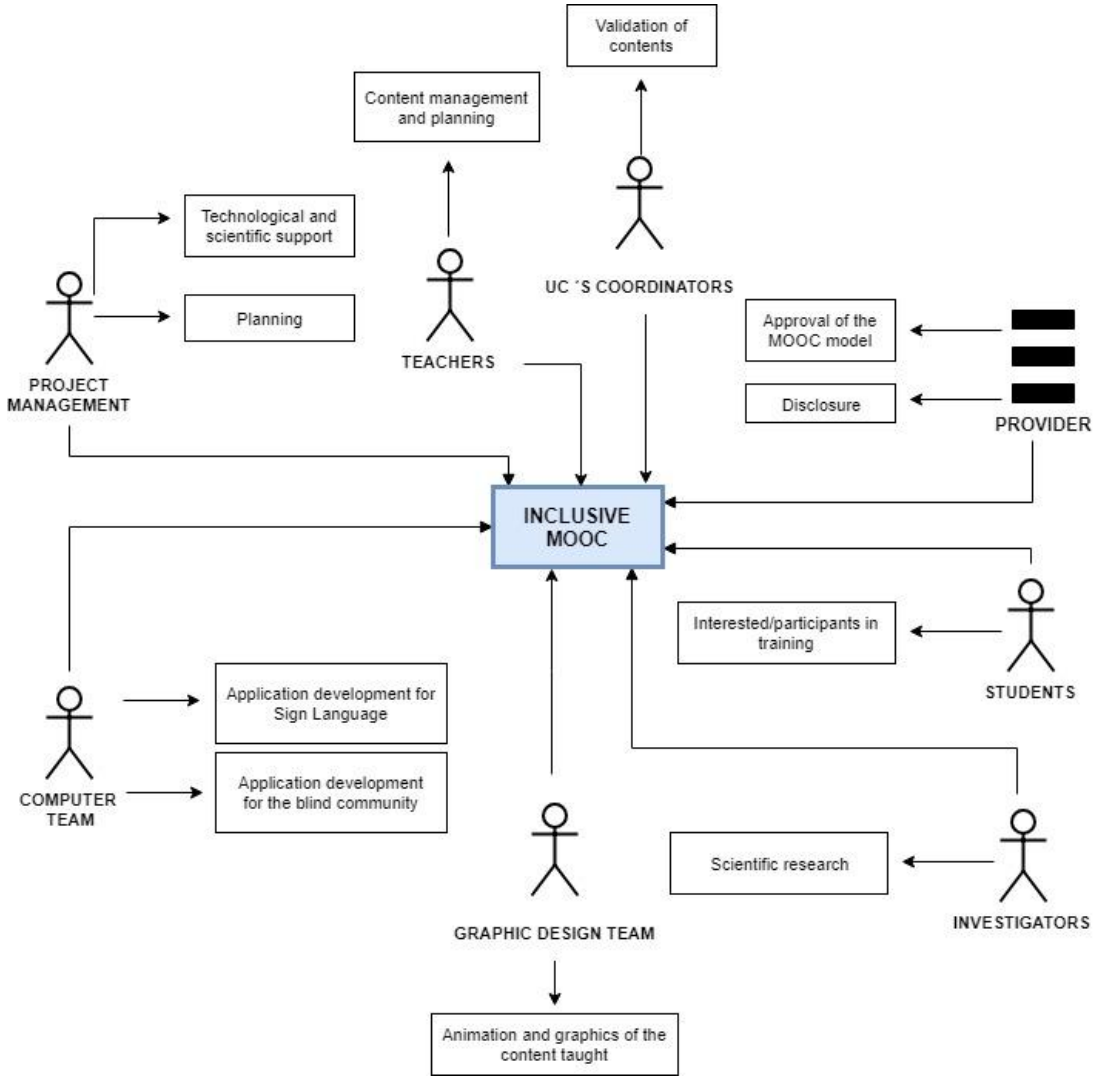

Figure 1. Active intervenients in the innovative MOOC pedagogical model

The provider is responsible for disseminating the final result of this MOOC pedagogical model. Dissemination will take place within the provider's network of contacts, thus promoting the postgraduation degrees.

As for the participants, the target audience of the final product, the model also considers them, once they are the ones who will actually use the educational product to be made available in the provider's platform.

The teachers are responsible for planning and developing the contents, in which written texts (direct speech), images, videos (tutorials, for example), among others are included. Afterwards, the structure of the lessons is validated by the coordination team responsible for each course unit, and/or by the responsible teacher (in this case the design team is in charge of correcting and adjusting the audio only to guarantee the sound quality).

The research team (Investigators, in Figure 1) is responsible for the research on the blind/visually impaired and the deaf/hearing impaired people's specific needs so that the digital content is provided appropriately in the platform enable a fluid and intuitive interaction.

Finally, the project management team, in addition to supervising the planning, provides technological and scientific support to the project, thus contributing for a successful development.

2.2 Implemented Solution

The proposed solution for the pedagogical model implementation is described in this section, where it is also possible to understand how the inclusion of the digital contents to be accessed also by the deaf/hearing impaired and the blind/visually impaired is considered.

In Figure 2 each element represents a fundamental role in the implementation structure: the digital content repository (DB), where all the digital materials concerning each course unit's lessons are stored, the responsible(s) for content validation, the content experts (teachers), who may use diverse tools as support to provide their contents (Word, PowerPoint, video, among others), the Kinect and the Sensor gloves the equipment which enables feeding the system with the Portuguese Sign Language specifications to be read by the computer, the avatar incorporated in the material to be made available to the students, which allows the output of written text translated into Sign Language.

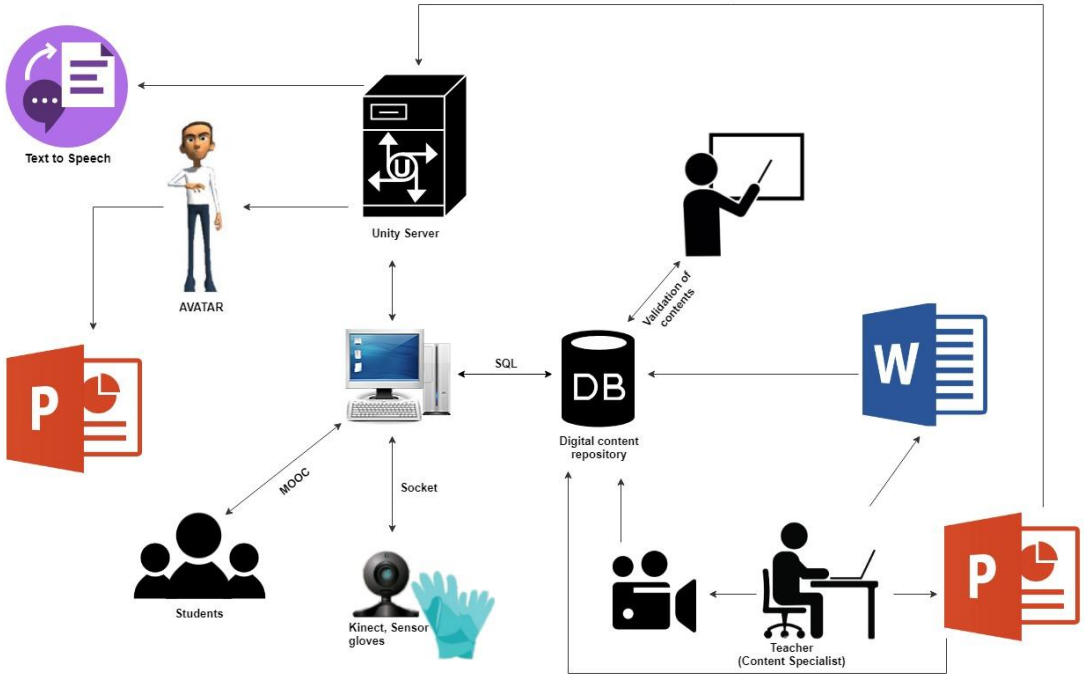

Figure 2. Design Solution

The MOOC developed based on the proposed pedagogical model must be clear, objective and user-friendly for all, inclusive of the deaf/hearing impaired and the blind/visually impaired as already stated. It is expected that the participants are provided with an environment that allows them to clearly understand how to interact with the contents so that they may succeed in accomplishing the tasks.

In order to guarantee the effective success of this MOOC pedagogical model, the Quantitative Evaluation Framework (QEF) was selected. This evaluation framework will enable controlling the quality of the final product by controlling its development process.

3. QEF IN DIGITAL CONTENT EVALUATION

Clearly indicate advantages, limitations and possible applications. Following the creation of the MOOC pedagogical model in Educational Technologies, this section presents the quality and evaluation model used to guarantee the quality control of the digital content produced. This quality model - the Quantitative Evaluation Framework - applies a survey-based analysis and a MOOC model example (Escudeiro & Bidarra, 2006). What is more, the quality and evaluation model for quality control of the digital content proposed in

this paper is sustained in software engineering objectives, principles and actions set for evaluating digital content.

The educational branch of software engineering integrates processes, methods and tools in developing evaluation models for educational contents aiming to improve their quality. This quality and evaluation model may be generally applied in the development of contents for digital systems in order to validate and evaluate them throughout their development cycle in any of its phases, therefore enabling the immediate detection and correction of possible flaws.

The model complies with the SCORM standards and references to the (ISO 9126) standard, proposing a quantitative representation in an orthogonal three-dimensional environment involving the pedagogical, the ergonomics, and the management domains. Each of these domains comprises a set of factors for which it is quite relevant to determine the performance degree within the system, being the factor a component that represents the performance degree of the digital content in the system, following a predetermined quality criterion (Escudeiro & Bidarra, 2008).

3.1 The dimensions of Digital Contents

The pedagogical dimension is mainly supported in the learning. Learning is determined by several factors which imply the interrelation between the individual, usually identified as student/participant, and the object, identified as the pedagogically featured technological instrument. In this context, the evaluation is an instrument in the pedagogical practice that allows to verify which are the most valid technological procedures in pursuing the educational objectives (Bloom). Within the MOOC pedagogical model in Educational Technologies, in the pedagogical domain, two factors were considered: learning and evaluation. The quality requirements/criteria associated to each factor in this domain are represented in Table 1. Each quality requirement/criterion proposed identifies the metrics, thoroughly selected, which will allow a quantitative assessment of the dimension it refers to.

The ergonomics domain handles the human being's scientific knowledge and its conception when applying it to building equipment and tools that will guarantee the global performance in a certain educational system. This domain assures that those tools and equipment are used to promote comfort and safety, that is, that they have the required conditions to their appropriate use in the learning environments. For the ergonomics dimension, the pedagogical model of the MOOC in Educational Technologies has considered the following factors: usability, video/audio, and text. In this intermediate stage the Ergonomics dimension of our quality environment considers those factors to be essential as they imply the easy use of the interface without disregarding the interaction with its functions within the system. In other words, they refer to the degree with which the participant is allowed to perform the tasks efficiently (Escudeiro & Bidarra, 2008). The requirements/criteria relating to the usability, video/audio, and text factors in the Ergonomics domain are detailed in Table 1.

The Management domain dimension references to the digital educational resources that clearly allow to explore the unique characteristics of technology, promoting learning processes that cannot be developed using other conventional means, therefore promoting innovation in digital educational resources. This dimension reflects the management characteristics of the educational digital contents as regards the operational aspects. The intermediate stage of the Management dimension of the quality environment we are proposing congregates two factors: content management and adaptability. The quality requirements/criteria of the Management domain are detailed in Table 1 as well.

ISBN: 978-989-8533-78-4 © 2018

Table 1. The Dimensions applying the Quantitative Evaluation Framework

Dimension	Factor	Requirements
Pedagogical	Learning	- Contents must be hierarchically and sequentially planned. - Contents must be divided into several knowledge stages, always starting in the least complex stage. - Contents, the course unit core, must reflect the best scientific or pedagogical evidence available concerning the subjects to be handled, and must be internally coherent, i.e. the considered subjects have to be clearly linked and interconnected. - In each lesson/video class the interaction with the participant/attendee must be considered by including content-related questions directly addressed to the participant/attendee. - A course unit must provide constructive feedback. - A course unit must be prepared for participants with different profiles/disabilities.
	Evaluation	- A course unit must provide problems to be solved in a short period of time. - The activities proposed in the course unit must consider the participants' collaborative work and skills. - The course unit must propose critical reflections about its contents and developed assignments. - The course unit must allow the participants to choose their path while attending it. - The course unit must promote interactions and foster team work. - The Special Education course units (deaf and blind) comprising specific scientific and pedagogical contents must be validated by experts in these fields.
Ergonomics	Usability	- The participant must be able to start and conclude each lesson when he/she wishes it. - The course unit must provide help through complementary material. - The lesson's complementary material must be of easy and intuitive access. - The course units must consider a uniform help pattern. - The course unit must have various audios available, compliable with the participant's needs (including the blind participants). - The course unit must allow the participant to configure the audio. - The deaf must have access to the digital content by means of an automatic bidirectional translator which translates the Portuguese written language into the Portuguese Sign Language. - The system must have an avatar to foster the interaction with the deaf participants. - A help button must be available for the deaf/hearing impaired. - A help button must be made available for the blind/visually impaired. - The lesson must use color combination appropriately (accessibility). - The lesson must make use of visual resources such as images and icons, in order to help transmitting the content better. - The lesson must consider human perception, i.e, must be prepared for the diverse participants' physical abilities/capabilities (deaf/blind). - The course must enable the participant to receive feedback in a forum.
	Video/ Audio	- The course is supported in digital video classes. - Video classes must have 8 to 10 minutes-length, corresponding to each lesson. - Each course unit must have a brief introduction to the lessons. - In the video edition, the use of images, graphics and animations must be specifically prepared for the blind/visually impaired by a detailed audio description. - The audio is recorded in Portuguese. - The whole text is presented in linear and concise form. - The text included is written in Portuguese.
	Text	- The lesson title must be clear, objective and appropriate to the content. - The content must be written following the Portuguese spelling agreement. - Whenever references are used, these have to be included in the bibliography.
Management	Content Management	- Contents are created by a team of certified experts in the field of knowledge. - There is a previous and appropriate content planning to assure the courses homogeneous features. - Contents must be validated by the course unit's responsible teacher. - Contents addressing the blind/visually impaired must be validated by experts in the field. - Contents addressing the deaf/hearing impaired must be validated by experts in the field. - Contents must be certified by the appropriately certified entities.
	Adaptability	- The course is adapted to be attended by the deaf/hearing impaired by integrating the 3D avatar. - The course is adapted to be attended by the blind/visually impaired by audio analysis and processing.

4. CONCLUSION

This paper proposed a qualitative model sustained in metrics that enable the quantitative measuring of the quality of a specific digital educational content in the context of the pedagogical model supporting the MOOC in Educational Technologies. The QEF – Quantitative Evaluation Framework – model, will be the basis for supporting, validating, evaluating, controlling and guaranteeing the quality in creating the digital educational contents. It will allow predicting the deviations in relation to the initial specifications, even before they are included in the educational course applied to the MOOC format. This method is being used in the development of the educational contents of the course units comprised in the Postgraduation Degrees of Educational Supporting Technologies at Instituto Superior de Engenharia do Porto.

It is important to highlight that the measurement of the quality of the digital educational content that this model allows requires is assured by quantitative methods, similar to the evaluation techniques commonly used in the Portuguese educational system, being therefore known by all the intervenient in the teaching/learning process, which makes its application quite simpler. As for the teaching technologies, producing quality digital educational content is the core purpose of any teaching/learning system. Hence, this model has been created making it possible to closely follow the development process of the digital content and, thus, control its production throughout the whole cycle. The QEF model may be applied in the evaluation of the development of any educational system, favouring from the direct comparison with different educational environments (Escudeiro & Bidarra, 2008).

ACKNOWLEDGEMENT

This research is being supported by ISEP (Instituto Superior de Engenharia do Porto), and GILT R&D centre (Games, Interaction and Learning Technologies).

REFERENCES

ECD, 2010. *ECD Portuguese legislation DL 75/2010*, url: http://www.ige.min-edu.pt/cdi/imagens/ECD_com_alteracoes.pdf, view on 03 May 2018.

Escudeiro, , P. & Bidarra, J., 2006. *X-TEC: Techno Didactical Extension for Instruction/Learning Based on Computer - A new development model for educational software*, Setúbal, Portugal, WEBIST 2006.

Escudeiro, P. & Bidarra, J., 2008. In: *E-Conteúdos para E-Formadores – Avaliação de conteúdos digitais* [*E-Contents to E-Trainers – Evaluation of digital contents*]. s.l.: s.n.

Escudeiro, P., 2016. *Formalização da Tese.* Porto: s.n.

ESTAE, 2012. *Informational site of post-graduate specializations at ISEP*, url: http://www2.isep.ipp.pt/estaei/, view on 05 February 2018.

GILT, 2016. *Virtual Sign.* [Online], Available at: http://gilt.isep.ipp.pt/projects/virtualsign/ , Accessed February 2018.

ISEP, 2016. *Modelo Pedagógico Recomendado para MOOCs.* Porto: s.n.

Marques, B. P., Carvalho, P., Escudeiro, P., Barata, A., Silva, A. & Queiros, S. (2017). *Post Graduations in Technologies and Computing Applied to Education: from F2F Classes to Multimedia Online Open Courses*. Nunes and McPherson (Ed.). ELearning 2017 Conference, Lisbon, Portugal. 20 – 22 July. IADIS. ISBN 978-989-8533-63-0., Pp. 55-62.

Marques, B. P., Escudeiro, P., (2016), *Training Portuguese Teachers using Blended Learning - A Different Approach*. Nunes and McPherson (Ed.). ELearning 2017 Conference, Madeira – Portugal Lisbon. IADIS. ISBN 978-989-8533-51-7. Pp. 185-190.